DRAFT responses to 2/27/2017 EPA Comments on Excelsior's December 2016 Responses, Excelsior Mining Arizona Gunnison Copper Project, Class III UIC Permit Application

Attachment A

1. (1)[1] Provide a proposal to demonstrate the effectiveness of wellfield operations and conduct model validation and, if necessary, recalibration based on early Stage 1 operations performance, prior to full implementation of commercial-scale ISR operations in Stage 1 and later stages. An EPA review of this early performance and demonstration of effectiveness will be required prior to EPA approval and initiation of full-scale commercial operations. The timeline for this initial demonstration phase should not exceed two years. The proposed intermediate monitoring wells and other well locations for this initial phase should be specified and shown on a map in the updated application. Subsequent monitoring well locations, proposed as ISR operations expand, will be subject to prior EPA approval.

Excelsior should amend and update the application accordingly.

Excelsior Response:

Excelsior plans to operate the wellfield as a commercial, full scale, operation, starting small in the first several years. Excelsior recognizes that the data collected over the first year of operations are important in evaluating the performance of the groundwater computer model that has been used to support the hydraulic control containment scheme. Full scale operations over time will provide a more complete understanding of in-situ conditions and what, if any, changes are necessary for control of mining solutions. Excelsior understands that EPA will require review of the early performance of the mining operation and will commit to providing a detailed report describing the first year's performance and evaluation of the groundwater computer model. As long as the Gunnison in-situ wellfield is operating in compliance with the permit conditions, there will be continued production and expansion per the mine plan.

During the first year of in-situ mining, considerable data and operational experience will be gathered and compiled. All wells designated as intermediate monitor wells (IMWs) will be fitted with a transducer that will measure both water levels and specific conductivity at least once daily. Recovery and injection rates for all Class III wells will be recorded on a daily basis. Water levels at observation wells will be monitored to show an inward gradient at the hydraulic control wells. A summary report will be provided to EPA. Model updates and adjustment will be completed, as needed. This will include updated hydraulic parameters, comparison with IMW results, and simulation(s) to demonstrate hydraulic control. If changes are needed to improve control, Excelsior will propose them as part of this report.

[1] Each response is numbered with the comment number in EPA's February 27, 2017 letter followed by the original comment number in EPA's October 14, 2016 letter (and Excelsior's December 2016 response) in parentheses. These numbers are not always the same.

This may include changing the sequence of HC well installation or pumping rates. Excelsior will continue operations during the EPA review and comment period.

Excelsior proposes the following procedures to demonstrate the effectiveness of wellfield operations, to conduct model validation, to recalibrate the model based on early Stage 1 operations (if necessary), and to document compliance with permit conditions.

> Task 1. Gather operational performance data including injection and recover flow rates, water level data fro m all HC and observation wells, IMWs, and POC wells , and specific conductivity data from IMW's and observation wells . All data will be maintained in a database. Supporting information such as groundwater elevation maps and specific conductivity distribution will be prepared.
>
> Task 2. Update the Excelsior groundwater model with the constructed locations of all operational wells, POC wells, and monitor wells. This task may involve refining the model in the area of the wellfield to allow simulation of wellfield operations.
>
> Task 3. Develop model simulation of the first year's operations by inputting the average monthly pumping and injection rates. The model simulation would include monthly stress periods (where all boundary conditions such as pumping are held constant).
>
> Task 4. Compare the model predictions of water levels with field measured water levels. Determine if the model predictions match field measurements and make local adjustments to the model input assumptions such as hydrauli c conductivity if necessary and re -run the model. Use statistical parameters for wells that have been shown to be influenced by mine operations. Statistical parameters may include the mean, standard deviation, absolute mean, and root mean squared error.
>
> Task 5. Prepare a report describing the model validation. The report will detail the assumptions input to the model, all changes made to the model, the model results, and an assessment of the model performance.

Excelsior will amend Attachment A-2 of the UIC application to include the tasks described above.

Attachment A-1, Area of Review Method, Groundwater Modeling Report, Aquifer Testing Report

Section 3. Hydrogeologic and Operational Considerations

3.1.1 Site Specific Characteristics, Unsaturated Basin Fill.

2. (2) The Underground Source of Drinking Water (USDW) definition at 40 CFR § 144.3 includes "or (B) Contains fewer than 10,000 mg/l total dissolved solids; and (2) Which is not an exempted aquifer." The basin fill saturation qualifies for that part of the definition, but may not qualify on the basis of "sufficient quantity to supply a public water system "if not considered part of the underlying bedrock aquifer. EPA believes there is sufficient evidence to include the basin fill saturated zones as h ydraulically connected and part of the bedrock aquifer, and that it should be included within the aquifer exemption as presented in the Excelsior response.

Excelsior should amend and update the application accordingly.

Excelsior Response:

Excelsior agrees to exempt the saturated portion of the basin fill aquifer within the AOR. Excelsior proposes that the top of the exemption zone proposed in the UIC application be changed so that basin fill below 4185 feet in elevation will be included in the aquifer exemp tion. This elevation is based on groundwater levels in NSH -006 and NSD -020, which are the only two wells screened solely in the basin fill, and which have saturated alluvium

Excelsior will amend the Section 3.1.1 of Attachment A -1 and other pertinent secti ons of the UIC application to reflect this change.

3.1.2 Low Conductivity Sulfide Zone.

3. (3) EPA agrees that the pump testing data for the sulfide zone indicate a lack of sufficient capacity or quantity of groundwater to supply a public water system well. However, the proximity of the two wells tested to known faults and fractures in the sulfide zone is not known. Hydraulic conductivity (HC) could be much higher in the fault zones, as it is in the oxide zone, and some of the faults are known to transect the oxide-sulfide boundary. One option is that monitoring wells (MWs) could be installed and screened in the sulfide zone in close proximity to the fault zones to better assess the hydraulic connection between the oxide and sulfide zones and to monitor for vertical excursions into the sulfide zone. Applicant should propose MW locations, subject to EPA approval.

Portions of the sulfide zone may qualify as a USDW and require protection from contamination or should be included in the exempted zone. Injection well depths should not penetrate within 40 feet of the sulfide zone as a precaution unless the upper sulfide zone is included in the exemption zone. Excelsior suggested that the upper 200 feet of the sulfide zone could be included in the exempted zones to address this concern and presented more information regarding the close proximity of the two sulfide test wells to faults that transect the oxide-sulfide interface. The absence of a confining layer between the oxide and sulfide zones means that an exchange or mixing of aquifer fluids between the oxide and sulfide zones during ISR operations is likely to occur where injection and recovery wells are situated near a fault zone and the oxide-sulfide interface. The possible exchange or mixing of fluids between the oxide and sulfide zones will be enhanced due to the drawdown of the hydraulic control and recovery wells in the oxide zone and pressure increases with outward flow at the injection wells.

Excelsior should amend and update the application to include the additional relevant information provided in connection with conference calls with EPA and add a proposal to include the upper 200 feet of the sulfide zone in the aquifer exemption zone.

Excelsior Response:

Excelsior agrees that the upper 200 feet of the sulfide zone should be incorporated in the aquifer exemption. The UIC application will be amended to reflect this in Attachment A-1 (Section 3.1.2) and Attachment S. The hydraulic conductivity in the sulfide zone is low, as demonstrated by aquifer tests at NSH-025 and NSH-014B. However, there is a possibility of fracture connections between the oxide and sulfide zones that were not identified by aquifer testing. Such connections would make portions of the sulfide zone a USDW. A request to exempt the top 200 feet of the sulfide zone will be made on this basis.

3.2.1 Hydraulic Gradients

4. (4) Excelsior modeled 1, 2 and 3 percent ratios of excess fluid withdrawals to injection rates and volumes within the wellfield to evaluate the feasibility of these scenarios for operation of the wellfield. However, Excelsior's prior response does not address the minimum extent of over-pumping at the hydraulic control wells necessary to maintain hydraulic control of injected fluids within the proposed wellfield operation. The proposed wellfield design and operation is acceptable with some modification and flexibility for over-pumping recovery wells and/or reducing injection rates in the event of outward movement of ISR fluids and exceedances of conductivity and water level alert levels detected at intermediate monitoring wells (IMWs). The IMWs will be located within the AOR between the downgradient hydraulic control wells and the active mine blocks and upgradient to the active mine blocks. A required minimum over-pumping rate at HC wells should be established during ISR operations which demonstrates maintenance of the minimum required drawdown gradient between observation wells and hydraulic control of ISR and rinsing fluids. The appropriate over-extraction rates will be determined and monitored on an individual HC well basis, depending on maintenance of the required minimum inward gradient at the observation well pairs.

Excelsior should amend and update the application accordingly.

Excelsior Response:

Excelsior has proposed that demonstration of hydraulic control depend on an inward hydraulic gradient as opposed to a fixed or defined amount of overpumping at the HC wells. This is appropriate, because if observation wells are in a high conductivity zone, the gradients will be low and pumping may need to be increased to maintain the inward gradient. Conversely, if the observation wells are in a low conductivity zone, gradients will be higher and pumping rates can be lower. A set amount of overpumping could result in insufficient hydraulic control pumping in high conductivity areas and too much pumping in low hydraulic conductivity areas. However, Excelsior understands EPA's desire to quantify a net extraction rate for the wellfield.

HC pumping will gradually ramp up as mining proceeds and new HC wells are added. Over-pumping, represented by the HC wells will therefore vary as indicated in Table 12 of Appendix A-2 of the UIC application. The performance of the HC system will be measured/confirmed using the observation well pairs installed adjacent to some of the HC wells. The observation wells will be used to measure the magnitude of the inward gradient to the HC wells. The minimum inward gradient is proposed to be 0.01 ft/ft. This inward gradient is the best indicator of the successful operation of the HC system to contain the migration of mining solutions. Therefore, Excelsior proposes to use daily measurements of the hydraulic gradients toward the HC wells to demonstrate hydraulic control, not rates of hydraulic control pumping. In addition, Excelsior proposes to initially pump the HC wells at a rate equivalent to one (1) percent of the injection rate. If this rate results in excessive gradient at the observation wells, Excelsior will inform EPA and reduce the rate to a level needed to maintain an inward hydraulic gradient of 0.01 ft/ft or greater.

Excelsior's proposed method of operating the wellfield maintains capture (as demonstrated by the model), minimizes dewatering, conserves the water resources, builds in flexibility and allows for site-specific capture should high-permeability faults be intersected. The persistent cone of depression created in the wellfield will grow with time, eventually resulting in a drawdown of over 40 feet.

5. (5) Modeling predictions are subject to errors due to preferential flow paths coincident with the fault plane orientations and other factors that are difficult to model accurately. Injection wells that are near a fault zone oriented in a west -to-east direction could overcome the n atural gradient to the east and cause flow to the west if recovery wells are not capturing the entire flow from those wells before exiting the western limits of the wellfield and area of review. We recommend placement of observation well pairs or monitorin g wells on the west side of the wellfield to monitor electrical conductance and water levels as suggested by Excelsior in their response and later discussions during conference calls. If the gradient is not sufficiently inward toward the wellfield at any w ell pair, action would be required to reverse the gradient by means of increasing extraction or decreasing injection rates or increasing HC well pumping to increase drawdown at the wellfield.

Excelsior should propose /monitoring well locations at the weste rn perimeter of the wellfield at a spacing consistent with the PowerPoint (PPT) presentation viewed during the meeting with Excelsior on February 9. In addition, observation wells should be placed to the south of the westernmost HC well in Figure A -7A in A ttachment A -1 of the response document. Final proposed locations for HC and observation wells will be subject to EPA approval. The outer observation wells of all well pairs and intermediate monitoring wells should also be equipped with conductivity sensors to monitor for movement of ISR fluids beyond the wellfield. The PPT presentation viewed during the February 9th meeting should be included in the updated application and the application should be updated to be consistent with that presentation, subject to final EPA approval and permit conditions.

Excelsior Response:

The following text will be added to Section 3.2.1 of Attachment A-1:

> *As indicated in Figure A-8, attached, Excelsior is proposing a network of intermediate monitor wells (IMWs) that includes ex isting wells along the western boundary of the wellfield. The IMW system is designed to act as a real -time early warning system to ensure the appropriate hydraulic control wells are installed and operating during mining. The IMW system includes an inner and an outer ring of monitoring wells that expand as mining operations expand. IMW's will be monitored for specific conductance and water elevation.*
>
> *The inner ring is primarily for operational use, allowing operators to observe the immediate effects of ch anges in operational conditions like injection or recovery rates. Some mining solutions are expected to be observed in these wells due to the sweep of solutions in and out of the margins of the active mining blocks. This is considered normal.*
>
> *The outer r ing is designed as an early warning system to ensure the appropriate hydraulic control wells are installed and operating. Appropriate alert levels for specific conductivity will be set in the outer ring of IMW's. Increasing trends above alert levels in ou ter wells would illicit the following response(s):*

Adjust operations to reverse the trend (pull back solutions) and/or

Install interceptor HC wells (if not already installed)

Adjust pumping in HC wells if needed

The location of the outer IMW's for Stage 1 is based on the aquifer testing that has already been completed in the in the proposed Stage 1 mining area. This aquifer testing shows the degree of connectivity between the pumping well and the surrounding obser vation wells. Figures A-9, A-10, and A-11 show the areas of influence of NSH -013, NSH -021C, and NSH -024, which are located within Stage 1 operations. The shaded areas represent the interpreted areas of influence, based on responses in observation wells. The composite area of influence of these three wells, as shown on Figure A-12, covers all of Stage 1. Figures A-9, A-10 and A-11 provide cross sections through each of the tested wells (NSH -013, NSH -021C, and NSH -024). The intent of the cross sections is t o show how the fault network at the site results in hydraulic connections over long distances. Bedding plane fractures, which are shown as dipping to the east, are lesser, but significant flow paths.

The general principle is to locate outer IMW's along th e more conductive fluid pathways (bedding parallel and structures), at distance of several hundred feet from the active mining area, in a radial pattern spatially distributed and surrounding the mining area. Irrespective of the IMW's exact location, the a quifer test results show that all the structures are hydrologically well connected, and as long as the IMW intersects either a structure or bedding parallel feature, it should respond to and detect potential migrations outside the active mining area in tha t direction.

IMWs will consist of existing core, observation or aquifer test wells, supplemented where considered necessary by additional wells to be drilled. Figures A-13, A-14, A-15, and A-16 show proposed IMW's for Year 1, Year 5, Year 10, and Year 1 3 respectively. Figure A-17 shows cross sections through Stage 1 blocks, showing the IMW locations and the significant structures that they intersect. Given the spacing and location of existing drill holes available to be used as an IMW, two additional h oles are proposed to extend coverage beyond existing locations. These drill holes (shown as stars on the above mentioned figures) will be drilled and installed as IMWs prior to commencement of production. As new mining blocks come online, any IMWs encompassed within that mining block will be abandoned.

A yearly schedule of proposed IMWs for Stages 1 and 2 is provided in Table A-1, along with well name, location, and open (or screened) interval. The primary structure(s) intercepted by the proposed Stage 1 and Stage 2 IMWs are provided on Table A-2. IMWs for Stage 3 will be identified according to a compliance schedule , with approval of EPA and ADEQ . As operational experience is gained, alternate or additional IMWs may be proposed, but in any event adhering to the general principle of IMWs. Excelsior will notify EPA prior to implementing significant departures from this plan.

As mining proceeds and rinsing operations are completed within a block or group of blocks, a selection of the old injection or recove ry wells will be converted to IMWs to monitor for later excursions into rinsed areas.

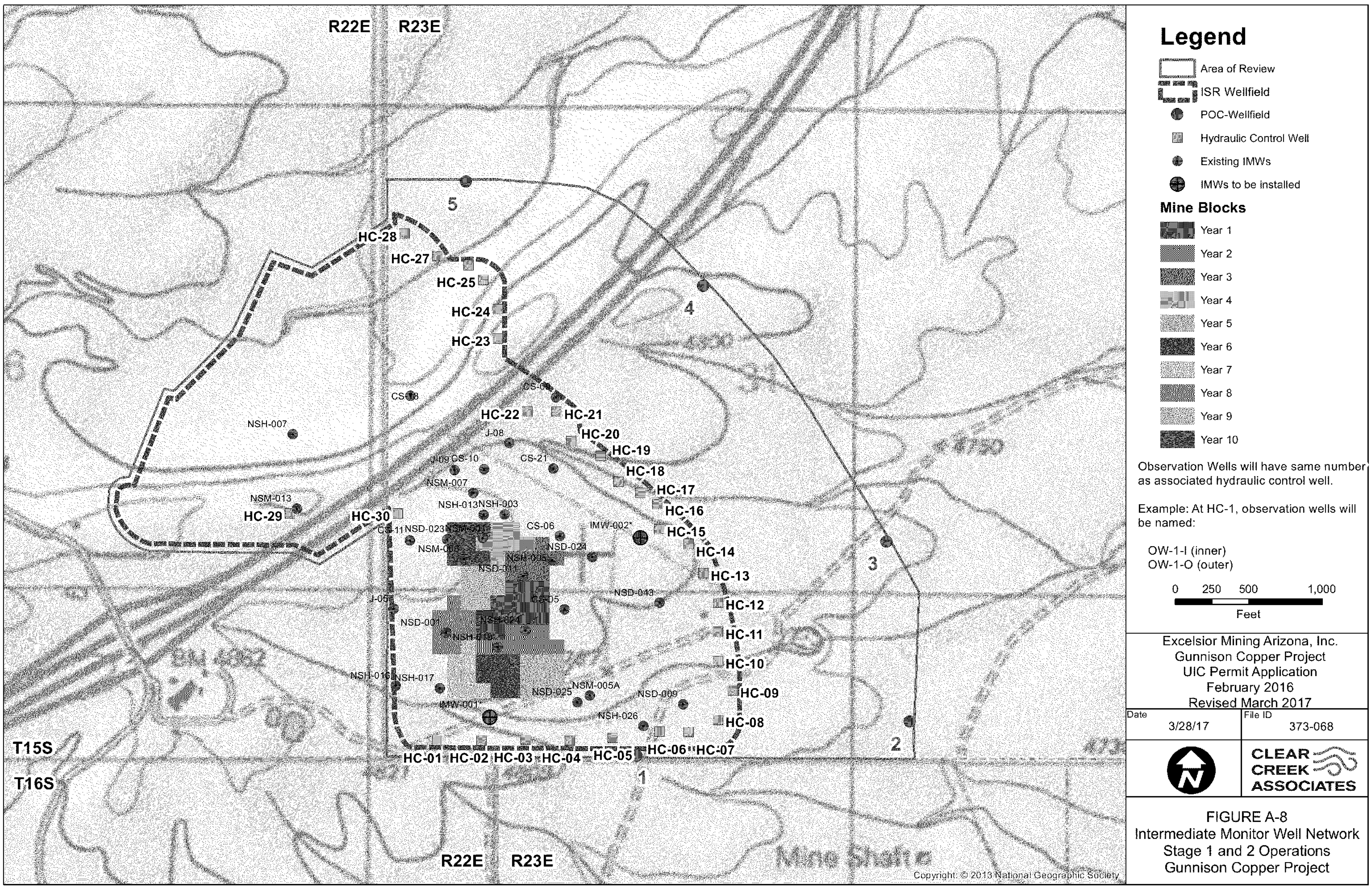
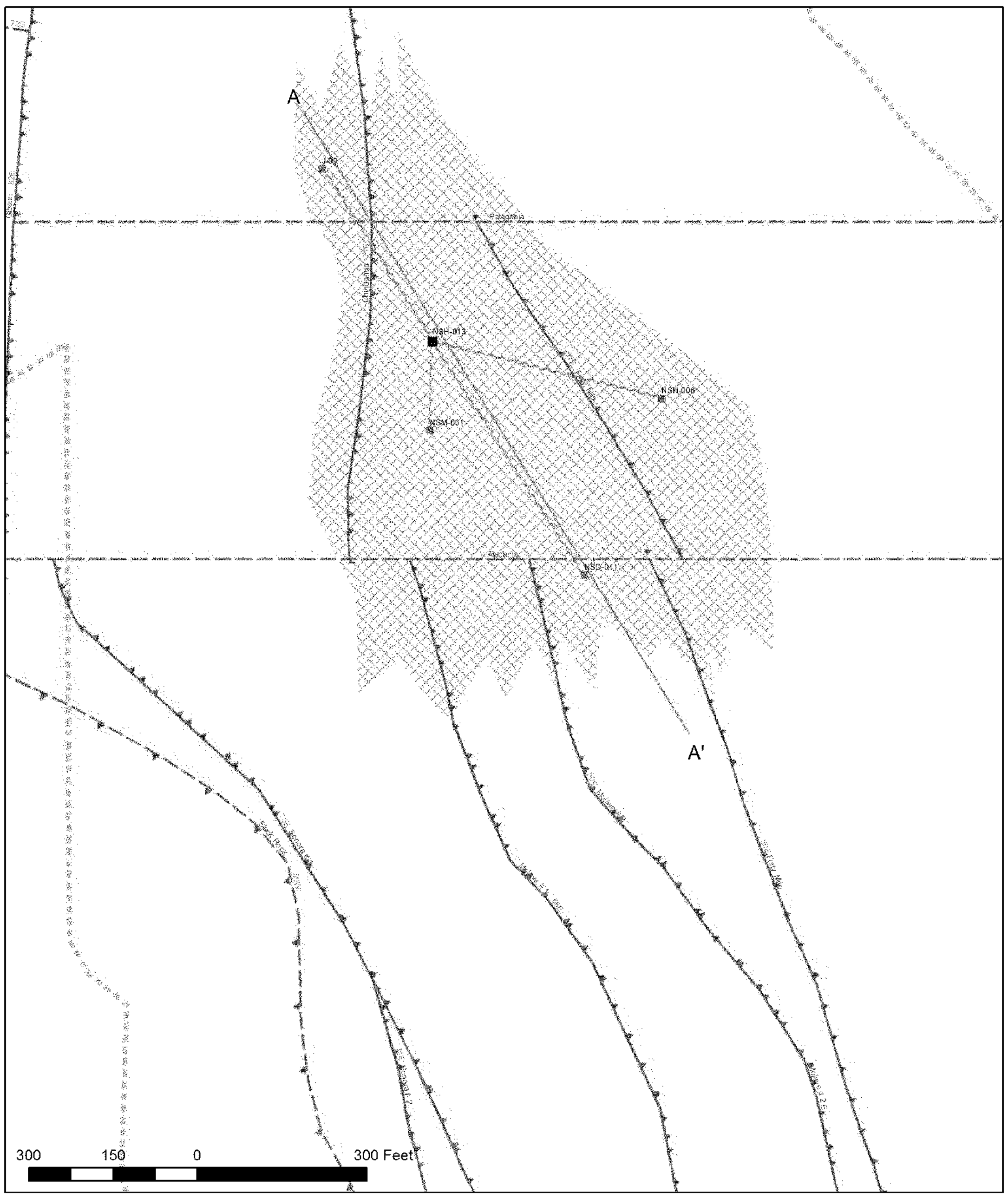
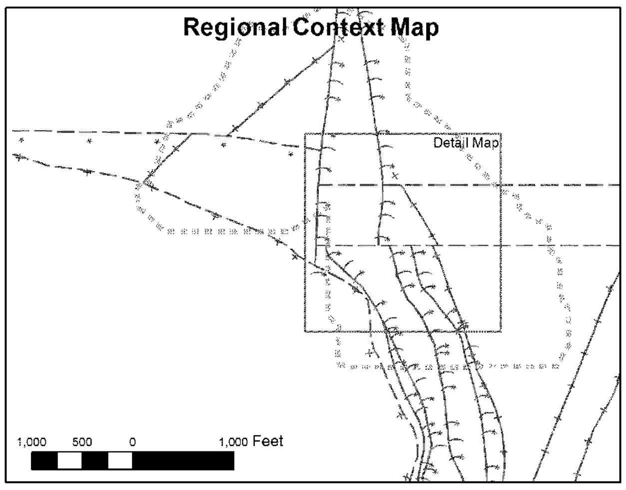
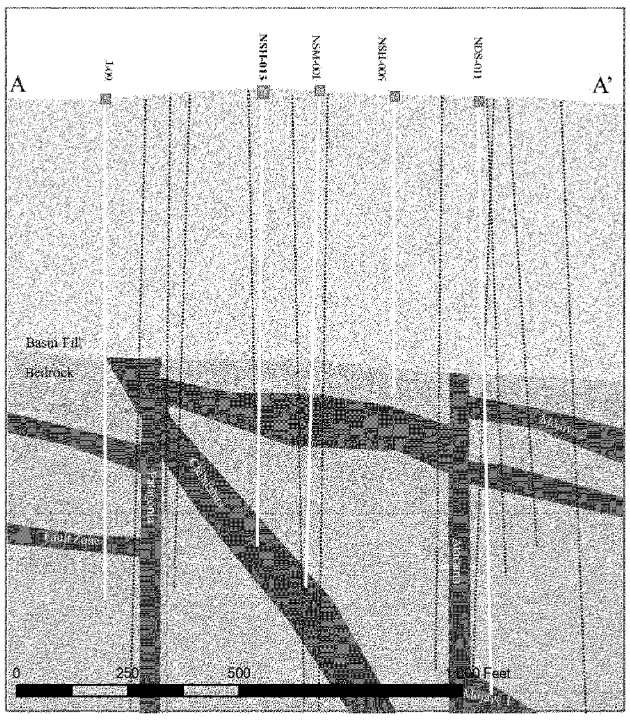


FIGURE A-8
Intermediate Monitor Well Network
Stage 1 and 2 Operations
Gunnison Copper Project





Cross Section NSH-013: A-A'



Legend

- Observation Well
- Pumping Well
- High Conductivity
- Moderate Conductivity
- Cross Section Line A-A'
- Aquifer Testing Area of Influence
- Approx Fault + Dip Direction (projected at bedrock surface)
- Wellfield Boundary
- ExplorationHole
- Fractured Wallrock

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Gunnison Copper Project
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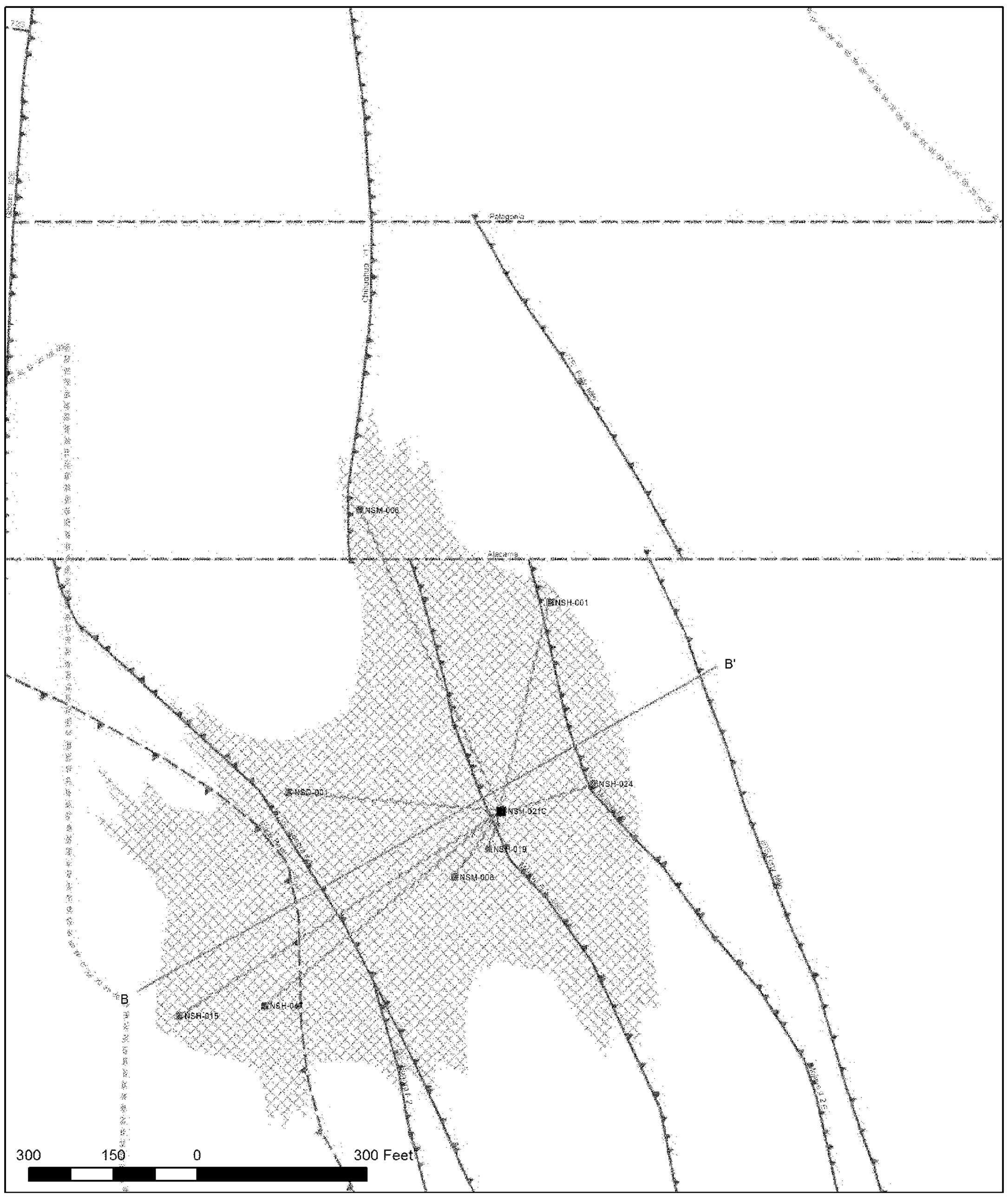
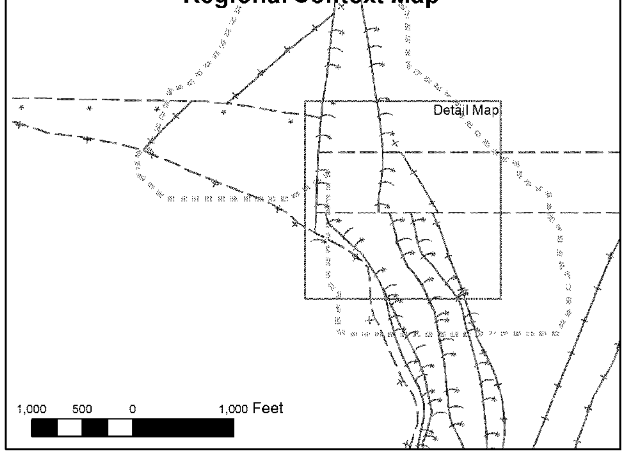
Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 Feet

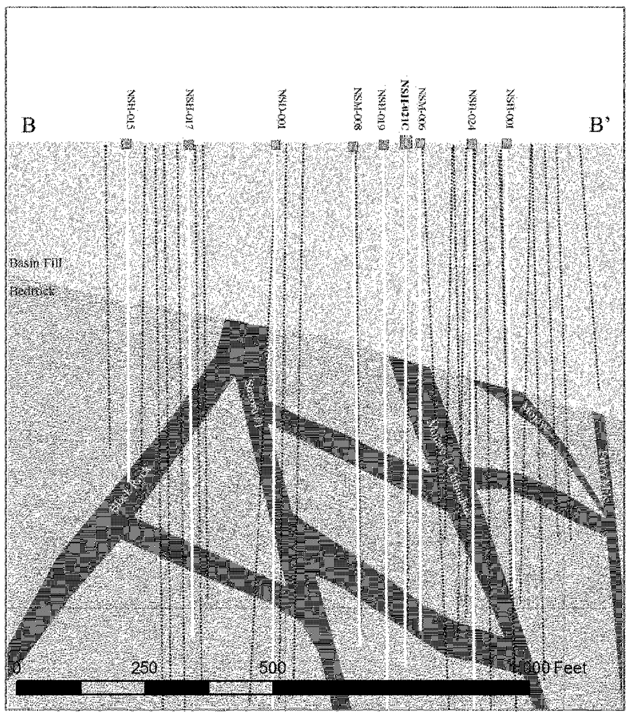
FIGURE A-9
AQUIFER TESTING AREA OF INFLUENCE
NSH-013



Regional Context Map



Cross Section NSH-021C: B-B'



Legend

- Pumping Well
- Observation Well
- High Conductivity
- Moderate Conductivity
- Cross Section Line B-B'
- Aquifer Testing Area of Influence
- Approx Fault + Dip Direction (projected at bedrock surface)
- Wellfield Boundary
- ExplorationHole
- Fractured Wallrock

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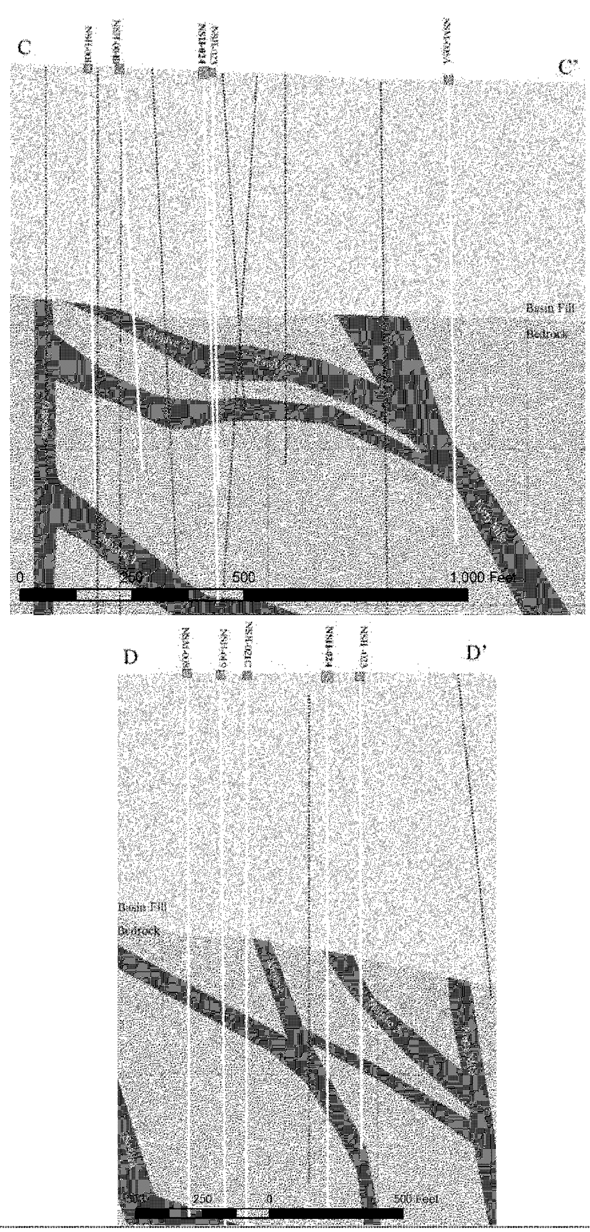
FIGURE A-10
AQUIFER TESTING AREA OF INFLUENCE NSH-021C

Cross Sections NSH-024: C-C' and D-D'



Legend

- Observation Well
- Pumping Well
- KKKK High Flow Strength
- KKKK Moderate Flow Strength
- Cross Section Lines C-C' and D-D'
- Section24Labels
- Aquifer Testing Area of Influence
- Approx Fault + Dip Direction (projected at bedrock surface)
- Wellfield Boundary
- ExplorationHole
- Fractured Wallrock

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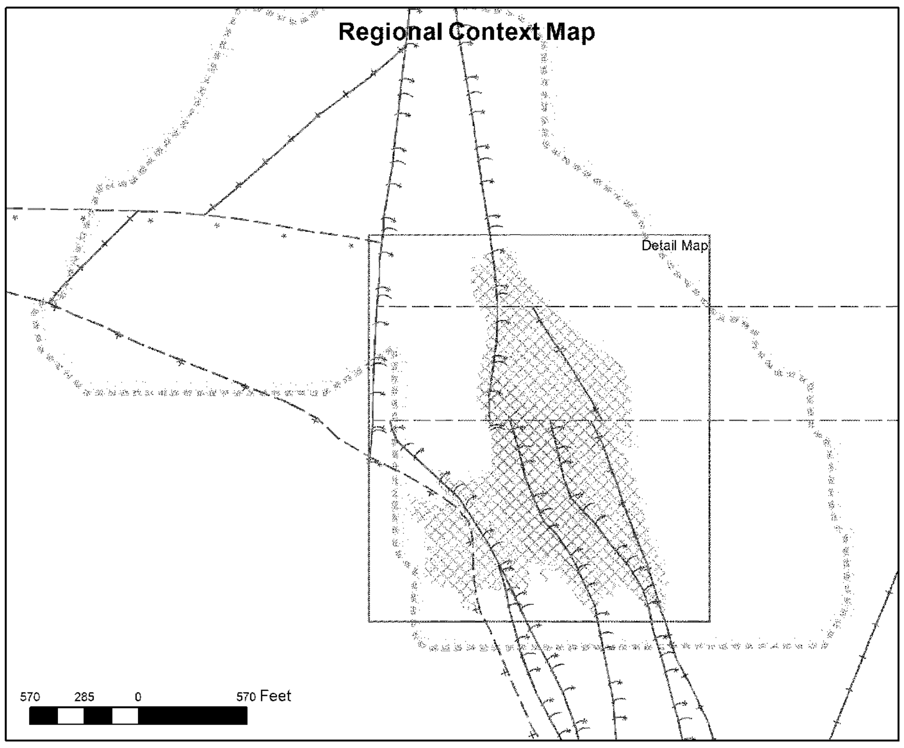
FIGURE A-11
AQUIFER TESTING AREA OF INFLUENCE
NSH-024



Legend

- Exploration Hole
- Observation Well
- Pumping Well
- Approx Fault + Dip Direction (projected at bedrock surface)
- Wellfield Boundary
- Aquifer Testing Area of Influence

Production

- Year 1

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NAD 1983
StatePlane Arizona
East FIPS 0201
Feet

FIGURE A-12
AQUIFER TESTING TOTAL AREA OF INFLUENCE: NSH-013, NSH-021C, NSH-024

Legend

Approx Fault + Dip Direction (projected at bedrock surface)

Cross Section Lines E - H

New IMW

Outer IMW

Inner IMW

Active HC Wells

Inactive HC Wells

Aquifer Test Influence Area

Wellfield Boundary

Production

Year 1

370 185 0 370 Feet

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Feet

FIGURE A-13
INTERMEDIATE MONITORING WELL LOCATIONS: YEAR 1

ED_001697_00000742-00015

Legend

Approx Fault + Dip Direction (projected at bedrock surface)

Cross Section Lines E - H

New IMW

Active HC Wells

Inactive HC Wells

Outer IMW

Inner IMW

Aquifer Test Influence Area

Wellfield Boundary

Production

Year 1

Year 2

Year 3

Year 4

Year 5

370 185 0 370 Feet

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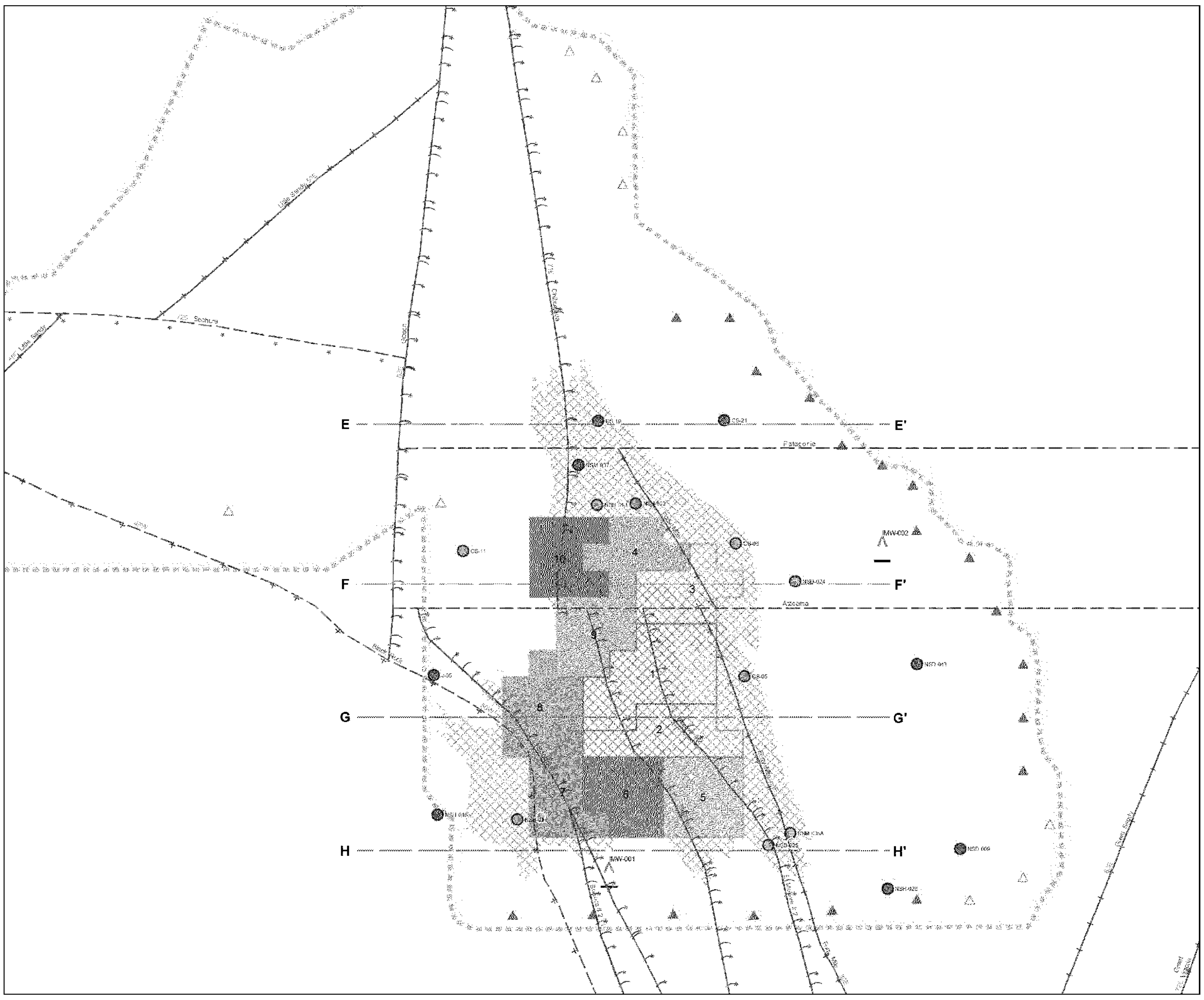
Coordinate System: NAD 1983
StatePlane Arizona East FIPS 0201
Feet

FIGURE A-14
INTERMEDIATE MONITORING WELL LOCATIONS: YEAR 5



Legend

Approx Fault + Dip Direction (projected at bedrock surface)

Cross Section Lines E - H

New IMW

Outer IMW

Inner IMW

Active HC Wells

Inactive HC Wells

Aquifer Test Influence Area

Wellfield Boundary

Production

Year 1 (Rinsed)

Year2 (Rinsed)

Year3 (Rinsed)

Year 4

Year 5

Year 6

Year 7

Year 8

Year 9

Year 10

370 185 0 370 Feet

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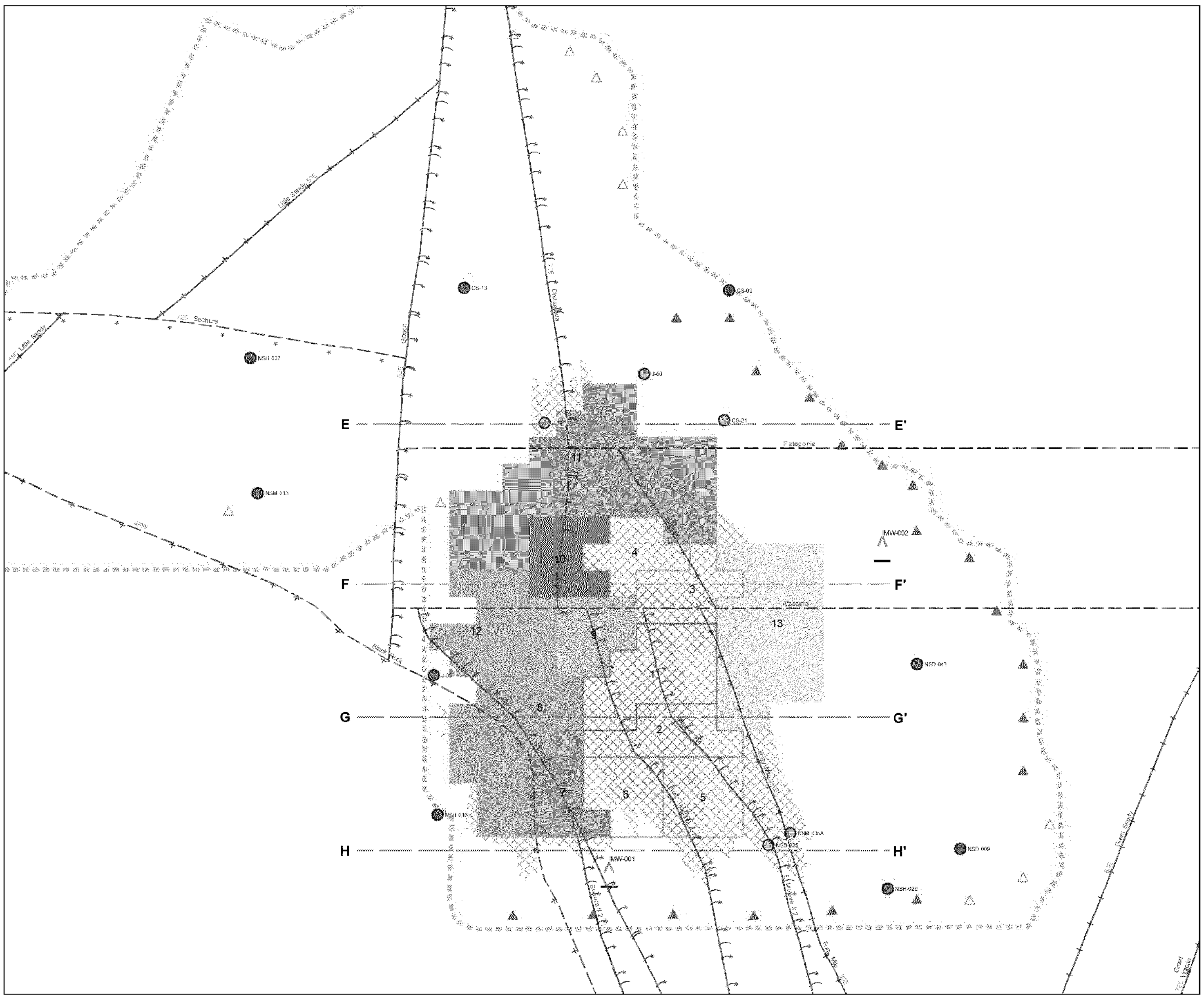
Coordinate System: NAD 1983
StatePlane Arizona East FIPS 0201
Feet

FIGURE A-15
INTERMEDIATE MONITORING WELL LOCATIONS: YEAR 10



Legend

Approx Fault + Dip Direction (projected at bedrock surface)
Cross Section Lines E - H
New IMW
Outer IMW
Inner IMW
Active HC Wells
Inactive HC Wells
Aquifer Test Influence Area
Wellfield Boundary

Production

Year 1 (Rinsed)
Year 2 (Rinsed)
Year 3 (Rinsed)
Year 4 (Rinsed)
Year 5 (Rinsed)
Year 6 (Rinsed)
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12
Year 13

370 185 0 370 Feet

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Coordinate System: NAD 1983
StatePlane Arizona East FIPS 0201
Feet

FIGURE A-16
INTERMEDIATE MONITORING WELL LOCATIONS: YEAR 13

ED_001697_00000742-00018

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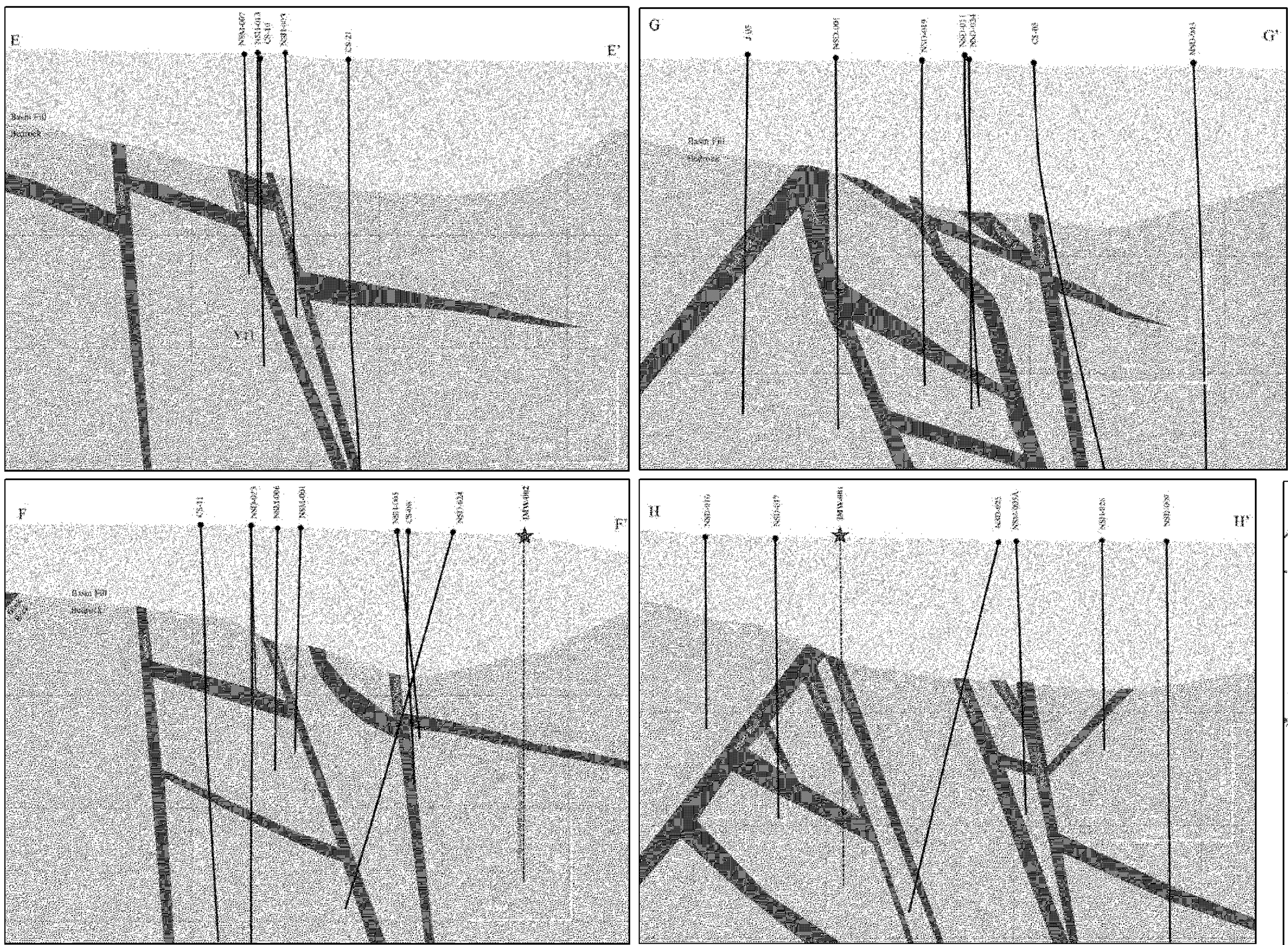
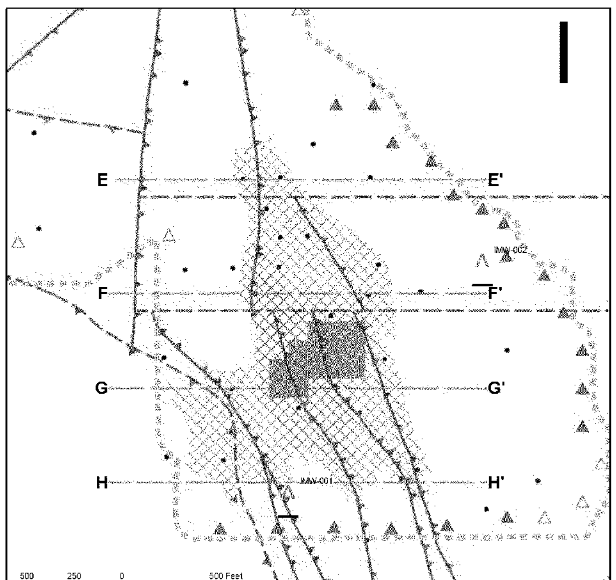
Gunnison Copper Project
Date Revised: 2/20/2017

Coordinate System: NAD 1983 StatePlane
Arizona East FIPS 0201 Feet





Legend

- New IMW
- IMW
- Pump Test Influence
- Wellfield Boundary
- Cross Section Lines E - H
- Active HC Wells
- Inactive HC Wells
- Approx Fault + Dip Direction (Faults projected at bedrock surface)
- **Production**
- Year 1
- Overburden
- Bedrock
- Fault Zone
- Fractured Bedrock
- IMW
- New IMW

FIGURE A-17
INTERMEDIATE MONITORING WELL LOCATIONS - CROSS SECTIONS E-F

Table A-1

Intermediate Monitoring Well Activity By Production

Generated 2/8/2017

IMW Activity by Production Year

O Outer IMW | I Inner IMW | A IMW Year Abandoned

	HOLEID	Azimuth	Dip	Collar Elevation (ft)	Depth (ft)	Lat	Long	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Screened	Screen Depth From (ft)	Screen Depth To (ft)
1	**NSH-019**	**0**	**-90**	4813.772	1410	32.0815879°	-110.0478899°	I	A														Open Hole	638	1410
2	**NSH-024**	**0**	**-90**	4819.07	1445	32.0819062°	-110.0428590°	I	A														Open Hole	625	1445
3	**NSD 011**	**0**	**90**	4834.35	1438	32.0829234°	-110.0429125°		I	A													N	645	1438
4	**NSH-005**	**0**	**-90**	4829.83	1040	32.0832251°	-110.0422664°	I		A													Y	747	1019
5	**NSM-001**	**0**	**-90**	4850.525	1150	32.0836335°	-110.0437963°	O	O		A												N	575	1150
6	**NSD 001**	**0**	**90**	4827.17	1506	32.0818639°	-110.0446091°	I	I	I	I	I	I	I	A								N	458	1506
7	**NSD-023#**	**180**	**-70**	4857.306	1546	32.0836150°	-110.0445842°	O	O	O	O	O	O	O	O	I	A						N	557	1546
8	**NSM-006**	**0**	**-90**	4847.479	1217	32.0832435°	-110.0441972°			I	I	I	I	I	I	I	A						N	541	1217
9	**CS-10**	**0**	**-90**	4828.54	1656	32.0849309°	-110.0437687°	O	O	O	O	O	O	O	O	O	O	A					N	730	1656
10	**CS 11**	**0**	**90**	4863.12	2084	32.0835938°	110.0454011°	O	O	O	O	O	O	O	O	O	I	A					N	481	2084
11	**NSH 003**	**0**	**90**	4846.072	1432	32.0840811°	-110.0478867°	O	O	O	I	I	I	I	I	I	I	A					Y	1232	1399
12	**NSH-013**	**0**	**-90**	4850.415	1070	32.0840678°	-110.0437796°	O	O	I	I	I	I	I	I	I	I	A					Open Hole	650	1070
13	**NSM-007**	**0**	**-90**	4844.188	1168	32.0844803°	-110.0440050°	O	O	O	O	O	O	O	O	O	O	A					N	600	1168
14	**NSH 017**	**0**	**90**	4806.813	1181	32.0808222°	-110.0447493°	O	O	O	O	O	O	I	I	I	I	I	A				Y	940	1181
15	**CS-05**	**0**	**-90**	4817.75	2034	32.0822957°	-110.0419956°		I	I	I	I	I	I	I	I	I	I	I	A			N	645	2034
16	**CS-06**	**0**	**-90**	4831.4	2160	32.0836703°	-110.0421043°	O	O	I	I	I	I	I	I	I	I	I	I	A			N	718	2160
17	**NSD-024#**	**270**	**-70**	4823.291	1972	32.0832737°	-110.0413848°	I			I	I	I	I	I	I	I	I	I	A			N	750	1972
17.5	***IMW 001****	***270***	***70***	*4798*	*1600**	32.0802743°	-110.0436410°	O	O	O	O	O	O	O	O	O	O	O	O	O	A		N (?)	*600 (approx)*	*1600 (approx)*
18	**NSD-009**	**0**	**-90**	4788.19	1793	32.0805145°	-110.0393900°	O	O	O	O	O	O	O	O	O	O	O	O	O	A		N	620	1793
19	**NSD-025#**	**270**	**-70**	4789.8	1644	32.0805525°	-110.0417146°	O	O	O	O	I	I	I	I	I	I	I	I	I	A		N	637	1644
20	**NSH-026**	**0**	**-90**	4794.091	905	32.0819062°	-110.0428590°	O	O	O	O	O	O	O	O	O	O	O	O	O	A		Open Hole	625	905
21	**NSM 005A**	**0**	**90**	4786.902	1172	32.0806787°	110.0414465°	O	O	O	O	O	O	I	I	I	I	I	I	I	A		N	592	1172
22	**CS-21**	**0**	**-90**	4809.94	2171	32.0849350°	-110.0422414°	O	O	O	O	O	O	O	O	O	O	I	I	I	I	A	N	688	2171
23	**NSD-043**	**0**	**-90**	4802.365	1736	32.0824201°	-110.0399104°	O	O	O	O	O	O	O	O	O	O	O	O	O	O	A	N	630	1736
23.5	***IMW-002*#***	***180***	***70***	*4800*	*1600**	32.0836339°	110.0403275°	O	O	O	O	O	O	O	O	O	O	O	O	O	O	A	N (?)	*750 (approx)*	*1600 (approx)*
24	**J 05**	**0**	**90**	4836.75	1475	32.0823131°	-110.0457580°	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	N	415	1475
25	**NSH-016**	**0**	**-90**	4812.227	820	32.0808698°	-110.0457147°	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	Y	301	701
26	**CS-09**	**0**	**-90**	4832.68	2337	32.0862792°	-110.0421815°												O	O	O	O	N	685	2337
27	**CS-13**	**0**	**-90**	4767.88	1251	32.0863042°	110.0453846°												O	O	O	O	N	462	1251
28	**NSH-007**	**0**	**-90**	4773.177	620	32.0855837°	-110.0479752°												O	O	O	O	Y	536	616
29	**NSM 013**	**0**	**90**	4881.136	953	32.0841926°	-110.0478866°												O	O	O	O	N	405	953
30	**J-08**	**0**	**-90**	4810.4	1350	32.0854170°	-110.0432095°													I	I	I	N	661	1350
31	**J-09**	**0**	**-90**	4824.4	1158	32.0849096°	-110.0444145°													I	I	I	N	591	1158
34	** indicates planned IMW*																								
	# indicates angled IMW																								

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Table A-2

	Structure	NSH 017	NSD 001	NSD 025	IMW 001	NSH 016	NSH 024	NSD 011	NSM 005A	CS 05	CS 06	NSH 005	NSH 026	IMW 002	NSD 023	NSD 024	NSM 001	NSM 006	NSH 013	CS 10	NSM 007	CS 21	J 08	NSM 013	NSH 007	CS 11	CS 13	NSH 019	J 05	NSD 009	NSH 003	NSD 043	CS 09	J 09
1	**Black Rock**	1	2	2	2	1																												
2	*Bedding Parallel 840*	2	2	2	2	2																												
3	*Bedding Parallel 842*	1	2	2	2	2																												
4	*Bedding Parallel 843*	2	2	2	2	2																												
5	*Bedding Parallel 844*	2	1	2	2	2																												
6	**Sonora #1 & 2**		1	1	1		2								2													2						
7	*Bedding Parallel 823*		2				1								1		2	2	2	2	2					1	1	1						
8	*Bedding Parallel 845*		2	2	2		2																											
9	*Bedding Parallel 846*		2	2	2		2																											
10	*Bedding Parallel 848*		2	2	2		2																											
11	*Bedding Parallel 852*		2	2	2		2																					1						
12	**Mojave #1**			1			1	2	2																			2						
13	*Bedding Parallel 858*			2			1	1	2					2		2																		
14	*Bedding Parallel 856*			2			2	2	1					2		2																		
15	**Mojave #2**						1	1	2					2		2																		
16	**Forty Mile**						2	2	1	2	2	2	2	1		1	2													2				
17	*Bedding Parallel 828*								2	2	2	2	2	2	2	2	2													1				
18	*Bedding Parallel 826*								2	2	2	2	1		2	2	2																	
19	**BP 827**								2	1	1	1			2	2	2																	
20	**Atacama**														1	1	2	2	2															
21	**Chihuahua**														2		1	1	1															
22	*Bedding Parallel 837*																2	2	2															
23	**Gibson**														2		2	2	2						2	2	2							
24	*Bedding Parallel 823*		2				1								1		2	2	2	2	2					1	1	1						
25	*Bedding Parallel 860*																2	2	2	2	2													
26	**Chihuahua**																1	1	1	1	1	2	2											
27	*Bedding Parallel 825*																2	2	2	2	2	1	1											
28	*Bedding Parallel 824*																1	2	1	1	1		1											
29	**Patagonia**																			2	2	2	2	2										
30	*Bedding Parallel 822*																							1	2									
31	**Sechura**													1										2	1									
32	**Little Sandy**													2										2	2									

Indicates Direct Drill Hole Intersection with Specified Structure: 1

Indicates Secondary Connection with Specified Structure: 2

*Each of the proposed wells intercepts at least one large structure and numerous small and secondary structures

6. (6) The reported natural groundwater flow velocities in the model domain vary widely in the wellfield as illustrated in Figure A-4C. The specific flow velocity attributable to the wellfield area is not provided.

Excelsior should provide an estimate of average and maximum groundwater flow velocities within the AOR beyond the wellfield perimeter and the estimated travel time from the wellfield to the point of compliance (POC) wells at the eastern AOR boundary.

Excelsior Response:

To respond to this comment, the following text and associated figures (attached) will be incorporated into section 5.2 of Attachment A-2, the Groundwater Modeling Report, upon approval of EPA.

> *To estimate the velocities within the AOR and beyond the wellf ield perimeter, a simulation was run for 100 years following the end of active mining to determine the particle velocities and time to reach the AOR boundary. The simulation starts out with the head flow field after the 23 year mining period and terminati on of pumping. Water levels slowly recover during the simulation because no pumping is included in the simulation. Figure X1 illustrates the result of this simulation, with particles moving south and east from their initial locations near the perimeter of the wellfield. Table X1 below lists the average and maximum particle velocities over the simulation for particles within the AOR.*

Table X1 – Simulated Particle Velocities in AOR by Layer

Layer	Average Velocity (ft/d)	Maximum Velocity (ft/d)	Count
3	0.098	8.869	38319
4	0.120	3.893	42346
5	0.120	1.468	46321
6	0.157	0.765	12263
7	0.179	0.488	203

> *The count shown in Table X1 represents the number of particles evaluated within the AOR by the end of the simulation. Particles that moved beyond the AOR were excluded.*
>
> *Figure X-2 illustrates a histogram of the velocity distribution, showing particle velocities prior to leaving the AOR. As expected, particle velocities drop as drawdown conditions rebound to static conditions after mining ends. Average velocities drop from around 0.18 feet per day (ft/d) in the*

first decade to less than 0.10 within 20 years. Maximum velocities also decline over that period from 8 ft/d to less than 1 ft/d.

Figure X3 illustrates the time for particles to reach the AOR boundary, listing the number of particles which cross the AOR by decade. As evident in Figures X1 and X3, the initial surge in numbers is from particles crossing the southern boundary, while the later surge after 60 years is due to particles reaching the eastern boundary. This indicates that the timeframe to reach the eastern POC wells is quite long, and the simulation does not account for the geochemical changes over that timeframe, which have been shown to quickly neutralize the mining solutions.

Please note that the figure numbers (X1, X2 etc.) are placeholders and will be changed when they are incorporated into the application.

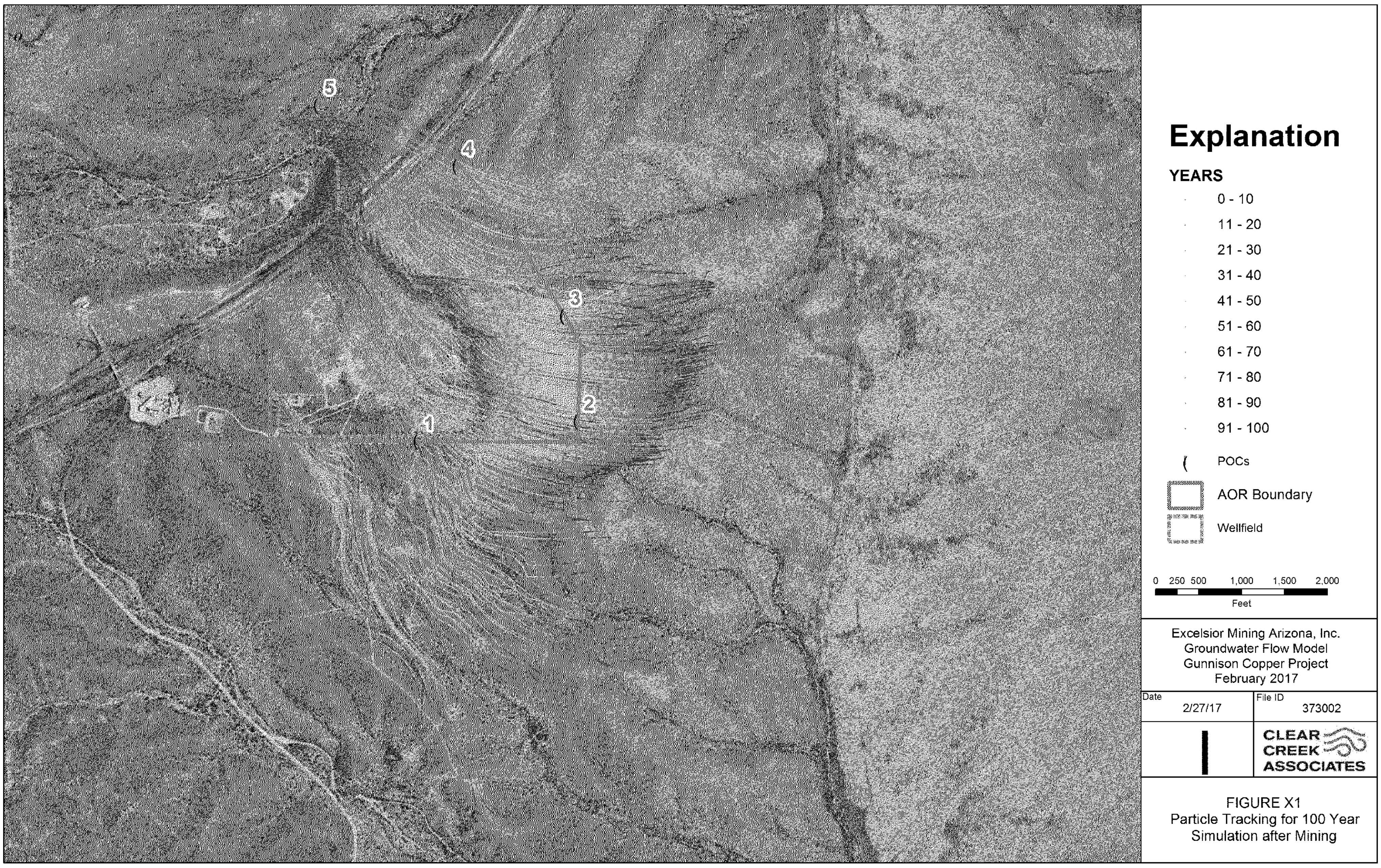
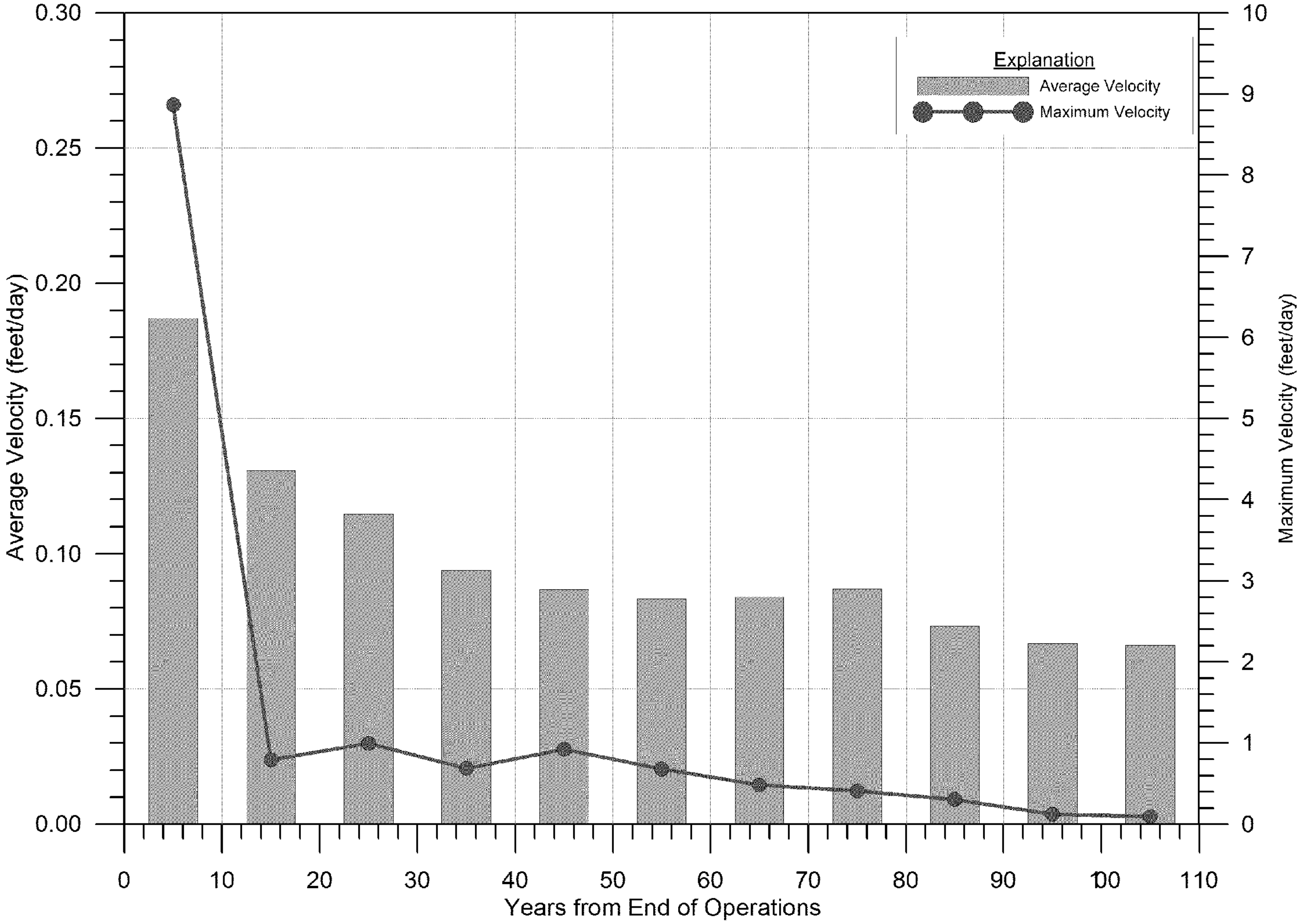
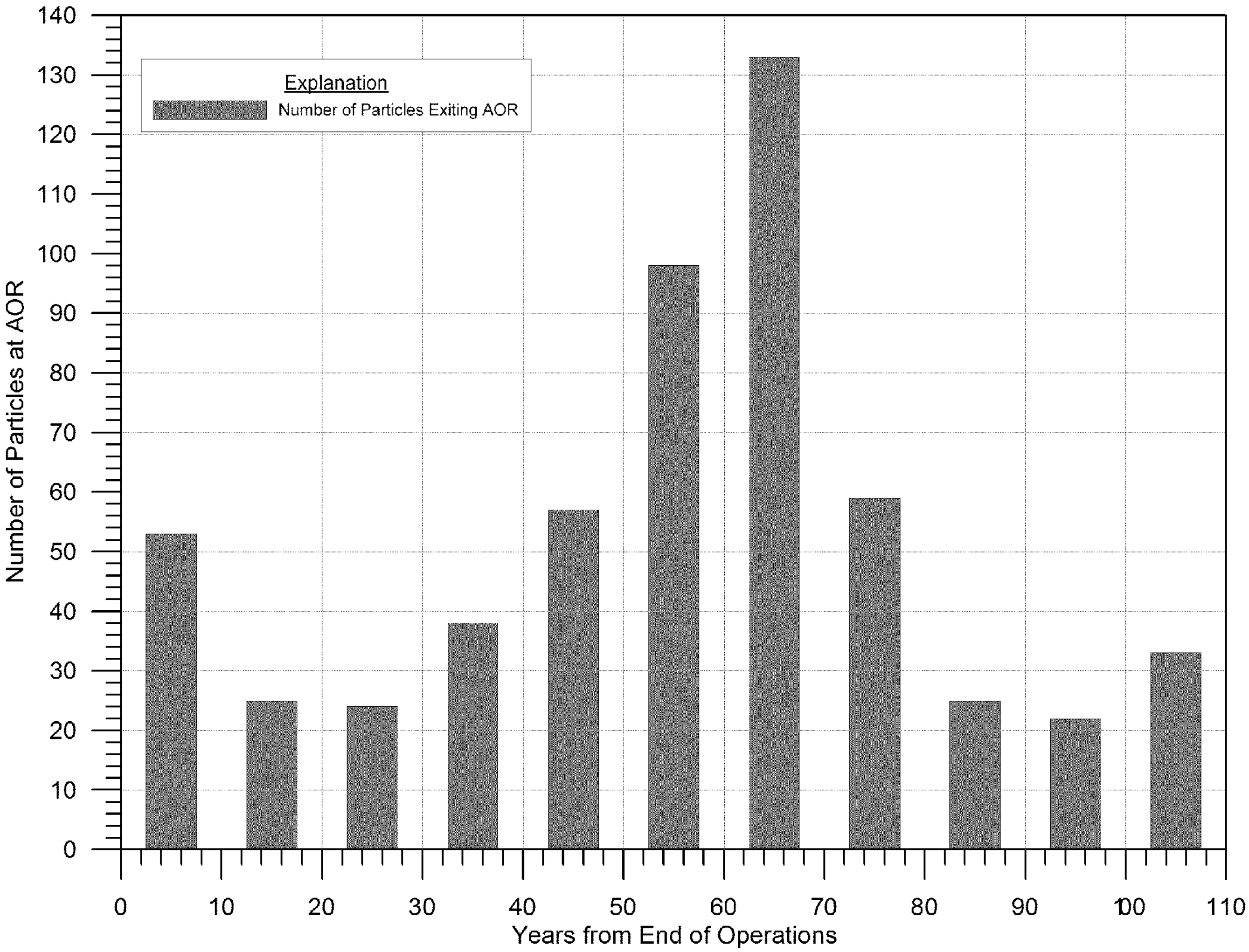


FIGURE X1
Particle Tracking for 100 Year
Simulation after Mining



CLEAR CREEK ASSOCIATES	Excelsior Mining Arizona, Inc. Groundwater Flow Model Gunnison Copper Project February 2017	**Velocity Distribution within AOR** **Particles Released at End of Mining** **UIC Permit Submittal** **Gunnison Copper Project**	**FIGURE** **X2**



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Excelsior Mining Arizona, Inc.
Groundwater Flow Model
Gunnison Copper Project
February 2017

Time to Exit AOR
Particles Released at End of Mining
UIC Permit Submittal
Gunnison Copper Project

FIGURE
X3